BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

As rescanning documents *will not* correct images, please do not report the images to the Image Problem Mailbox.

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 4 : G01N 33/48

A1

(11) International Publication Number: WO 89/ 04961

(43) International Publication Date: 1 June 1989 (01.06.89)

(21) International Application Number: PCT/US88/04051

(22) International Filing Date: 14 November 1988 (14.11.88)

(31) Priority Application Number: 119,950

(32) Priority Date: 13 November 1987 (13.11.87)

(33) Priority Country: US

(71) Applicant: TECHNE CORPORATION [US/US]; 614 McKinley Place Northeast, Minneapolis, MN 55413 (US).

(72) Inventor: BADY, Henri ; 14, impasse de Rocher, F-44470 Thouare-sur-Loire (FR).

(74) Agents: KAIHOI, Gregory, P. et al.; Fredrikson & Byron, 1100 International Centre, 900 2nd Avenue South, Minneapolis, MN 55402-3397 (US).

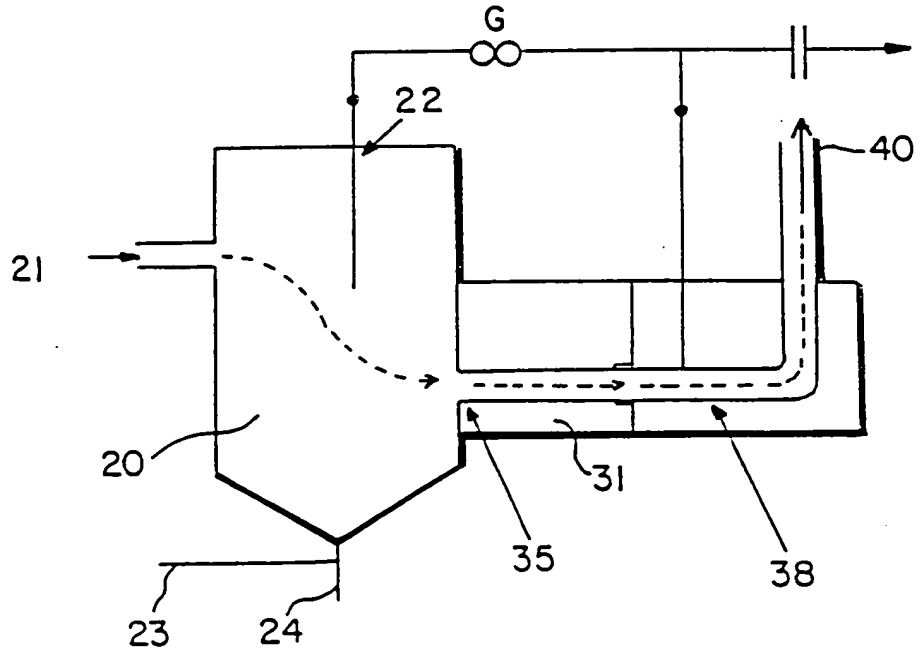
(81) Designated States: AT (European patent), BE (European patent), CH (European patent), DE (European patent), FR (European patent), GB (European patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent).

Published

With international search report.

Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: HEMATOLOGY CELL COUNTING APPARATUS



(57) Abstract

A hematology cell counting chamber for counting particulate blood components in a sample utilizing an impedance circuit. The unit includes a sample chamber (20), a generally linear passage (21) extending away from the sample chamber, an orifice (30) interposed generally between the sample chamber and the linear passage means, and an electrical circuit including a first electrode (22) disposed in the sample chamber and a second electrode (38) disposed in the linear passage means. The circuit means provides an electrical current within the sample to detect passage of blood particles through the orifice. The linear passageway is of a relatively small diameter to inhibit turbulence in the blood sample after it passes through the orifice, thereby reducing erroneous swirlback counting of such particles.

FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria
AU	Australia
BB	Barbados
BE	Belgium
BG	Bulgaria
BJ	Benin
BR	Brazil
CF	Central African Republic
CG	Congo
CH	Switzerland
CM	Cameroon
DE	Germany, Federal Republic of
DK	Denmark
FI	Finland
FR	France
GA	Gabon
GB	United Kingdom
HU	Hungary
IT	Italy
JP	Japan
KP	Democratic People's Republic of Korea
KR	Republic of Korea
LI	Liechtenstein
LK	Sri Lanka
LU	Luxembourg
MC	Monaco
MG	Madagascar
ML	Mali
MR	Mauritania
MW	Malawi
NL	Netherlands
NO	Norway
RO	Romania
SD	Sudan
SE	Sweden
SN	Senegal
SU	Soviet Union
TD	Chad
TG	Togo
US	United States of America

HEMATOLOGY CELL COUNTING APPARATUS

TECHNICAL FIELD

The invention relates to hematology analyzers for counting blood cells, and more particularly to a cell counting chamber system.

BACKGROUND OF THE INVENTION

Blood components including platelets, white blood cells, and red blood cells may be counted by at least two popular methods, the impedance method and laser systems. In the impedance method, liquid containing the particles of interest is diluted using suitable isotonic solutions, including an electrolyte such as sodium chloride or potassium chloride. A probe having a single orifice, typically a ruby with a very precise hole in it, is inserted into a chamber containing the diluted sample. Two electrodes are provided, one within the hollow chamber of the probe, and the other located in the sample. Upon applying voltage to the electrodes, an ionic current is induced in the electrolytic solution, the current of necessity passing through the ruby orifice.

Simultaneously with passage of the current, fluid is either drawn by vacuum or pumped into the probe through the orifice. As cells or cell particles pass through the orifice, they partially block the flow of electrolyte through the orifice, therefore changing the resistance or impedance in the circuit, a change which is detectable with a galvanometer or other suitable circuitry. Based on the amount and

duration of change ("pulse volume") in the resistance of the circuit, the type and number of cells passing through the orifice can be determined. White blood cells typically have a volume of about 120-1,000 cubic microns, red blood cells 85-95 cubic microns, and platelets 2-30 cubic microns.

A typical prior art probe is illustrated in Figure 1. An artifact of such probes is that passage of fluid through the ruby orifice creates turbulence within the probe, permitting a discernible percentage of cells to swirl back and again pass through the cell counting zone. Due to the dynamics of the fluid flow and electron flow, a cell passing through the zone a second time typically has a pulse amplitude significantly smaller, therefore causing errors in the cell count which are difficult to compensate for electronically.

It should be noted that when cells swirl back, as is graphically illustrated in Fig. 1, it is not necessary for the cells to actually pass backwards through the orifice for them to be detected. Rather, if they merely pass through the counting zone adjacent the orifice so as to temporarily interrupt or alternate current passage, such recirculation will be misinterpreted by the system, commonly as a particle of smaller size. Thus, for example, a recirculating red blood cell may be erroneously recognized as a platelet.

SUMMARY OF THE INVENTION

The invention relates to a counting chamber which includes an orifice mounted at the end of a hollow internal electrode through which a sample is drawn, as by a vacuum. The particles pass through a small opening before passing through the orifice, and continue in a straight path well beyond the counting

zone as they are being evacuated. Turbulence is therefore substantially reduced, and the swirlback effect drops substantially.

In a preferred embodiment, the system is comprised of three parts which are easily disassembled for cleaning. The parts include a sample chamber, the orifice mount, and the electrode, the latter two defining the evacuation passage. The three parts may be assembled to one another by snug fittings sealed with O-rings which are disassembleable from one another by hand.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a schematic cross-sectional view of a prior art probe tip including a counting orifice;

Figure 2 is a schematic view of the counting chamber system of the invention;

Figure 3 is a schematic drawing of the orifice and evacuation path;

Figure 4 is a schematic drawing of the chamber of the invention illustrating the separable parts;

Figure 5 is a cross-sectional view of a preferred embodiment of the invention; and

Figure 6 is a partially broken-away view of the area in which the orifice is mounted.

DETAILED DESCRIPTION OF THE INVENTION

Referring to Fig. 2, a sample which has been diluted to the proper proportion is drawn through input (21) into chamber (20) which includes an electrode (22). Cells are drawn, as by vacuum, toward and through an orifice (30), preferably a ruby orifice, and then pass through hollow electrode (38), and are aspirated away. Fig. 3 shows in schematic fashion the cell counting zone (35) centered about the orifice, and illustrates the substantially linear path of cells, which path effectively eliminates turbulence

which gives rise to swirlback and erroneous counting of blood components.

Figs. 4-6 illustrate in greater detail a preferred embodiment of the invention. The sample chamber (20) includes a cover (25) with a thumb screw (26) securing it in place. An air/bubble input (23) is provided for mixing, and a drain (24) is also provided to allow evacuation of fluids from the sample chamber (20).

The orifice mounting block (31) is snugly received within a complimentary fitting in the sample chamber block, and secured by pressure between the two pieces against an O-ring (32). The orifice mounting block (31) is provided with a rinse input (33) and rinse output (34).

The electrode mount (38) similarly fits into the other end of the orifice mounting block (31), secured by a similar O-ring (39). Fluid is evacuated through the distal end (40) of the electrode mount.

The three-piece manufacture of the chamber allows convenient disassembly and reassembly of the various pieces for cleaning and maintenance. The device therefore provides for a relatively simple solution to the otherwise complex problem of discriminating swirlback signals from true counting signals.

While a preferred embodiment of the present invention has been described, it should be understood that various changes, adaptations and modifications may be made without departing from the spirit of the invention and the scope of the appended claims.

WHAT IS CLAIMED IS:

1. A hematology cell counting chamber for counting particulate blood components in a sample utilizing an impedance ciruit, comprising a sample chamber, means defining a generally linear passage extending away from the sample chamber, orifice means interposed generally between the sample chamber and the linear passage means, and electrical circuit means including an electrode disposed in the sample chamber and a second electrode disposed in the linear passage means, the circuit means providing an electrical current within the sample to detect passage of blood particles through the orifice, the linear passageway being of a relatively small diameter to inhibit turbulence in the blood sample after it passes through the orifice, thereby reducing erroneous swirlback counting of such particles.

2. A hematology cell counting chamber system substantially as described and shown.

PRIOR ART

Fig. 1

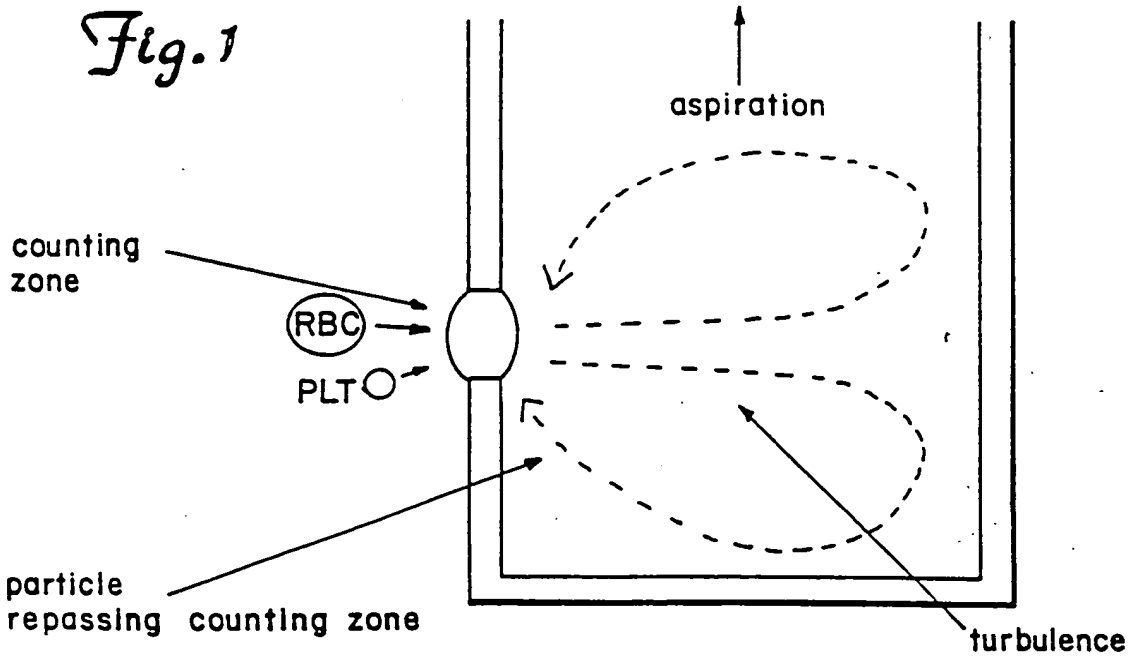
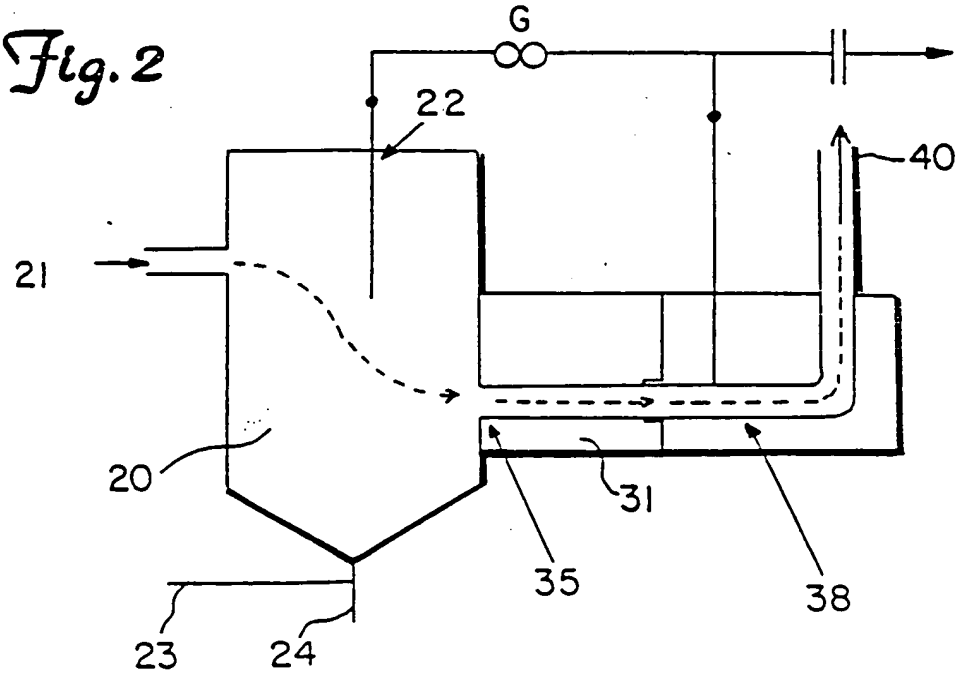


Fig. 2



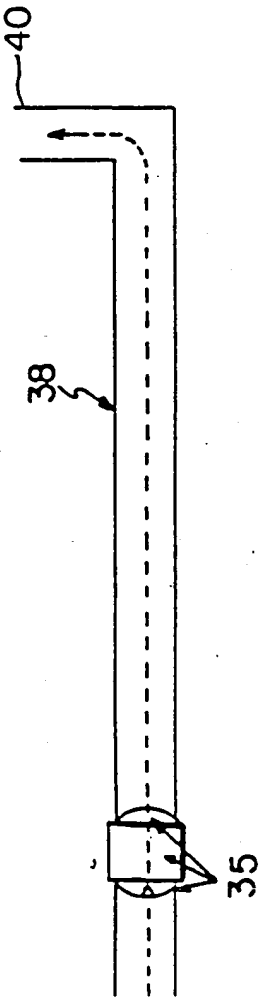


Fig. 3

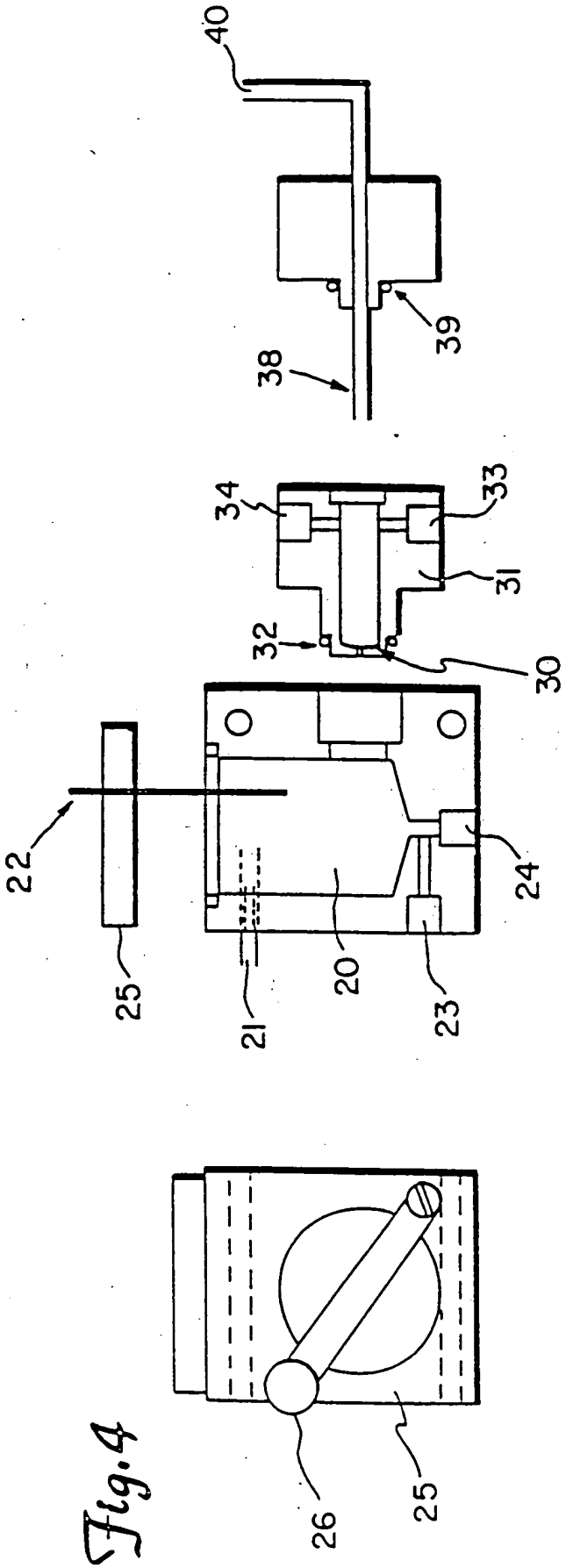


Fig. 4

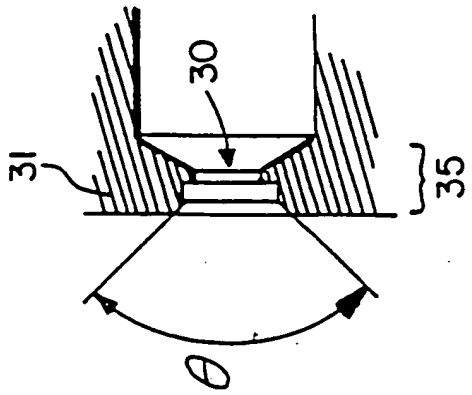


Fig. 6

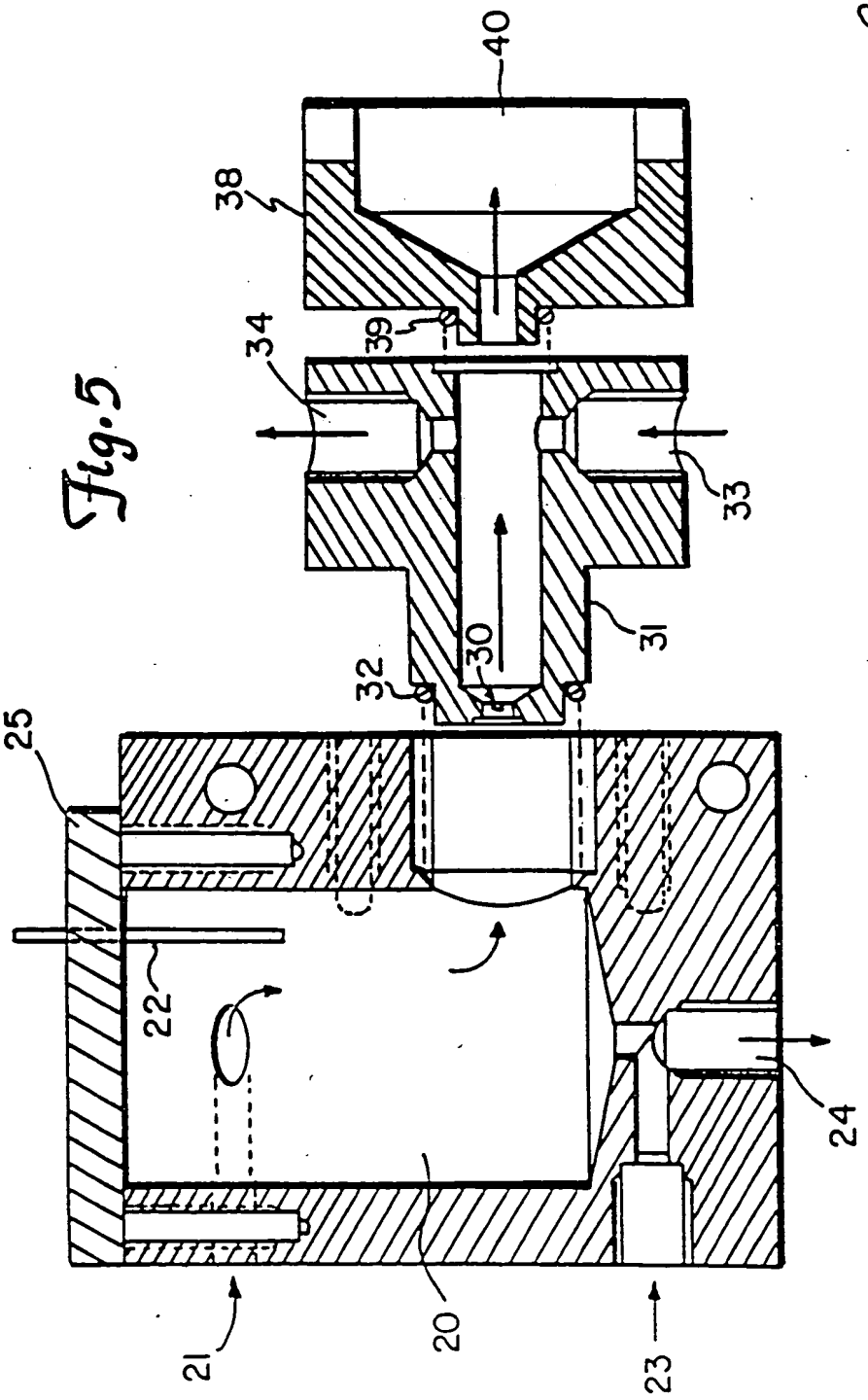


Fig. 5

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC(4): G01N 33/48

U.S. CL.: 422/73; 436/63

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
U.S.	422/73; 436/10, 63, 68.02, 68.05; 324/71.4

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category *	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
X	US, A, 4,198,160 (KACHEL et al), 15 April 1980 See the entire document.	1-2
X	US, A, 3,930,736 (COULTER) 06 January 1976, See the entire document.	1-2
A	US, A, 3,648,160 (BEAVER) 07 March 1972, See the entire document.	1-2

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search

02 February 1989

Date of Mailing of this International Search Report

20 MAR 1989

International Searching Authority

ISA/US

Signature of Authorized Officer

LYLE A. ALEXANDER